Adverse event detection, monitoring, and evaluation, Phase I

Completed Technology Project (2010 - 2010)

Project Introduction

This SBIR project delivers a single-sensor structural health-monitoring (SHM) system that uses the impedance method to monitor structural integrity, wave propagation methods to assess surfaces, and acoustic SHM to detect adverse events (impacts). This Adverse Event Detection (AED) unit supports nondestructive evaluation (NDE) systems and evaluates advanced composite structures. Implications of the innovation Increasingly demanding weight and performance needs encourage widespread use of composite materials. New systems are needed to detect incipient flaws in composites before damage becomes critical. Health analyzers that actively examine structures across several length and time scales in an autonomous fashion greatly reduce the number of sensors required and lower system complexity and cost; however, no practical system exists. We address this deficiency by building on our existing SHM system. Technical objectives AED leverages our previous NASA SHM research. Our initial Phase 1 prototype takes the form of a single custom printed circuit board, and is a TRL 5 unit. We have demonstrated both the impedance method and wave propagation SHM as implemented by a single sensor. Phase 1 will focus on performing similar demonstrations for acoustic SHM using the same single sensor element. Research description We have established feasibility for a chip-level approach that combines the impedance method and wave propagation, and demonstrated damage detection on a model composite. Phase 1 will validate chip-level feasibility for acoustic operation, and demonstrate this additional capability in a laboratory prototype. Anticipated results Phase 1 attacks the problem of monitoring structural integrity across multiple time and distance scales and completes a TRL 5 prototype that can be deployed wirelessly. Phase 2 delivers a TRL 6 unit that autonomously senses damage across several length and time scales by integrating impedance based, wave propagation, and acoustic SHM.

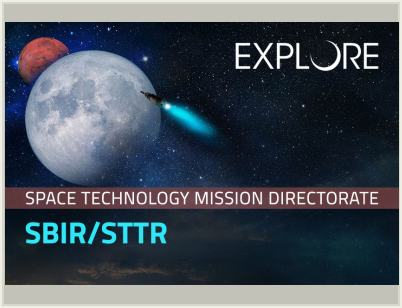

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Table of Contents

Small Business Innovation Research/Small Business Tech Transfer

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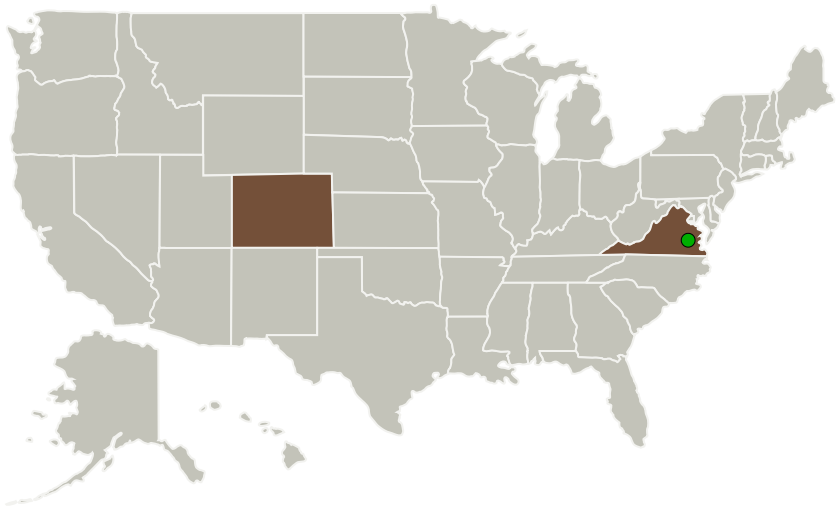
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Extreme Diagnostics, Inc.	Lead Organization	Industry	Boulder, Colorado
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Colorado	Virginia

Project Transitions

January 2010: Project Start

July 2010: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138803)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Extreme Diagnostics, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

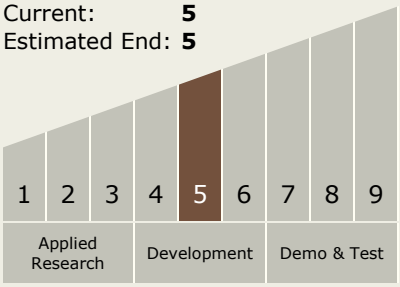
Carlos Torrez

Principal Investigator:

Robert B Owen

Technology Maturity (TRL)

Start: **5**
Current: **5**
Estimated End: **5**



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Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System